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EUROPEAN INTEGRATION AND BANK COMPETITION

Investigating the development of bank competition during the three most recent decades of European integration through comparing and contrasting competition indicators

Bachelor's Thesis
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Abstract

This paper examines the development of bank competition during the most recent decades of European integration. The period under investigation is from the early 1990s to the present because the 1990s marked the beginning of deeper integration. This was driven by factors such as the establishment of the Economic and Monetary Union and the European Union.

The analysis is conducted in the form of a literature review. The different methods of measuring bank competition play an important role in the paper, and the analysis is organized according to these different indicators. A distinction is made between structural and non-structural indicators. The former type measures market structure and the latter focuses on bank conduct and profitability. The most widely used indicators include but are not limited to Lerner index, H-statistic, and Hirschman-Herfindahl index.

Considerable differences are found to exist between results from different indicators. It is concluded that indicators tend to focus on different aspects of bank activities. Therefore, the indicator should be carefully chosen according to the interests of the study in question, and the results should not be used to infer competition levels in activities that the indicator is not suited to measure.

Although there are some inconsistencies between studies, the findings show that the bank competition level does not seem to have increased significantly during the investigation period. After a relatively stable level during the first decade of the period many researchers have reported increased competition before the 2008 financial crisis. In post-crisis years bank competition seems to have weakened for a few years, which has been followed by moderate increases in the 2010s. The levels in different countries have been seen to converge to one another; yet, differences still persist.

An important point that emerges from the analysis is that there seem to be considerable differences in competition levels between different types of banks. Banks that operate in larger geographical markets and rely less on traditional activities face stronger competition than do local banks that focus on traditional loan-and-deposit activities.

Keywords European integration, bank competition, Lerner index, Hirschman-Herfindahl index, H-statistic, European Union, bank specialization

Contents

1. Introduction

One goal of economic integration, in general, is to promote competition in all markets. The role of competition, for its part, is for example to ensure efficient allocation of resources and to encourage innovation. (e.g. Căpraru and Pintilie, 2017) Financial markets and banking markets are no exception to this.

In banking markets, increased competition should lead to convergence of interest rates and margins among banks and countries (Fernández de Guevara et al., 2007). It should at the end lead to the law of one price (Weill, 2013). The law of one price in the context of bank competition simply means that the price of banking products and services would be the same regardless of which country they are provided in. Is this expected to happen? There are currently several obstacles in the way towards the law of one price within the banking industry. Among the most prominent stand different levels of risk associated with different clients and activities, and the importance of bank-client relationships. (Fernández de Guevara et al., 2007)

Integration towards a single banking market should have many advantages. It leads to increased access to new markets, instruments and services. More integrated markets are generally assumed to foster competition which would then decrease prices of banking and financial services. These price decreases can further spur economic activity and efficiency as they mean lower costs for companies. (Andrieş and Căpraru 2012) Van Leuvensteijn et al. (2007) also point out the relevance of bank competition in monetary policy: changes in the policy interest rate of a central bank are passed on faster to the rates that customer face, if the banking market is competitive.

An additional factor that makes the discussion about competition in the banking markets of special interest is the potential trade-off between competition and stability. It is worth considering whether some degree of market power would actually be beneficial as it could incentivize banks to reduce the level of risk in their strategies. This question is especially relevant in relation to the recent financial crisis. (Casu and Girardone, 2009) When competition is high and banks have no market power, their profitability is low which makes them more vulnerable to shocks, thus potentially impairing stability (Bikker, 2003). A related potential trade-off exists between competition and bank risk-taking (De Jonghe et al., 2016).

A prime example of integration is found in Europe. This is chosen as the context of the discussion in this paper due to its uniqueness and its relevance in relation to the Finnish economy. Some of the most important steps towards European integration are introduced in section 2. So far, vast differences in banks' service prices and fees have been reported across European countries, for example by the European Commission. Differences reported include but are not limited to payment transaction fees, deposit interest rates and deposit account maintenance fees. (Bolt and Humphrey, 2009) These can be indicative of versatile competitive conditions within the EU.

These competitive conditions are clearly a relevant topic and worth analyzing. Since competition cannot be observed directly, there is a need for developing measurements for it (e.g. Bikker, 2003). Typically, studies on bank competition only use one or a few measures available which can be problematic because different indicators sometimes give conflicting results. There is no measure that would be widely agreed upon to be the best one. (Carbó et al., 2009)

The purpose of this paper is to investigate how bank competition has developed during the three most recent decades of European integration through comparing and contrasting different indicators. This is done in the form of a literature review. Two questions arise: How has the competition level developed in general? How have the levels in each country developed relative to one another? The time period of interest ranges from the early 1990s to the present. The beginning of the investigation period is chosen based on the fact that major changes towards integration took places in Europe during the 1990s.

Part of the literature reviewed for this paper offers extensive year-by-year estimates for the indicators in question which allows for assessing the evolution of bank competition. However, some literature only reports calculations of the mean during the investigation period and, therefore, mainly lends itself to more general comparisons among countries, as well as to be used as examples of applying the indicator in question. Naturally, only indicators that contribute something to the discussion are included.

The methods of measuring bank competition, i.e. the different indicators used, are given significant weight in this paper. Therefore, the analysis is organized according to the indicators rather than in a chronological order or according to the nature of the findings. The paper does not aim to address every indicator with equal weight nor depth. This is due to the fact that some indicators have been used significantly more often than others and, therefore, provide much more content to the discussion.

It is worth noting already that an indicator called the Lerner index clearly has the largest weight in the analysis due to its prevalent status as the most widely-applied measure.

The paper is structured as follows: Section 2 shortly reviews steps taken in Europe towards financial integration which provide the basis for the topic of this paper. Section 3 introduces two distinct approaches to measuring competition as well as some of their strengths and weaknesses. This is then followed by sections 4 and 5 which provide the core of this paper as they discuss evolution of bank competition in the EU through analyzing results from a variety of indicators which belong to the categories laid out in section 3. Section 6 continues by introducing a few newer indicators derived from the need for more consistent and accurate ways of measurements, and applies them to the EU. The different indicators are then compared in section 7. In section 8, evolution of bank competition is discussed further in the context of examining disparities and similarities across EU countries as well as different types of banks within the EU. Section 9 presents conclusions from the literature review, and the paper ends with a discussion in section 10.

2. Moving towards financial integration in Europe

The process of European integration, both economic and political, started already in the years after the Second World War in the form of the European Coal and Steel Community. Significant steps were taken along the way and the progress culminated in the establishment of the European Union in 1993 when the Maastricht Treaty came into force. (European Union, The history of the European Union) Since the foundation of the EU and the subsequent changes in the years that followed mark an era of significantly deeper cooperation and integration, this paper focuses on the three most recent decades, starting from the beginning of the 1990s.

The purpose of actions taken in Europe such as deregulation of financial services, and the introduction of the Economic and Monetary Union (EMU) and the euro has been to foster integration, for instance through removing entry barriers, and to promote competition and efficiency in the EU banking industry. (e.g. Casu and Girardone, 2009)

The First banking directive (1977) had already started removing obstacles to banking activities across the borders of European countries. It, for instance, harmonized rules for bank licensing. (Andrieş and Căpraru, 2012) Then, in the 1990s, a lot changed in the European banking sector.

A major step in European integration was founding the Economic and Monetary Union (EMU) in 1992. Its purpose is to coordinate economic and fiscal policies across member states and to establish a common monetary policy and a single currency. (European Commission, Economic and Monetary Union)

The Second banking directive which came into effect in 1993 created the single banking license (Weill, 2013). It meant moving towards mutual recognition of banking permits across country borders and, in doing so, aimed to create a single banking market. A financial institution that has been issued a permit by authorities in its own country, can function in any other EU country based on the same permit. In more general terms, the directive coordinated laws and regulations across countries. (Andrieş and Căpraru, 2012)

Establishing a common currency, the euro, in 1999 and implementing it fully in 2002 for example eliminated the exchange risk for banks which made cross-border activities easier (Weill, 2013). It was expected to reduce existing barriers and to promote internationalization.

1999 also marked the beginning of the Financial Services Action Plan (FSAP) approved by the European Commission (EC). It introduced a set of actions to be taken between 1999 and 2005 with the aim of opening up retail banking markets, homogenizing financial regulations in EU member states, and creating a single market for wholesale financial services. (Fernández de Guevara et al., 2007)

The steps introduced above are among the most important changes that set the stage for the 21st century European economies. They impact economic activity all over the union, and banking markets are no exception. This setting provides the framework for the discussion in this paper.

2.1 EU competition policy

One significant effect of these deregulation actions has been a push towards mergers and acquisitions (M&A). It is not easy to know how exactly such actions affect the competitive environment. Consolidation can indeed increase market concentration and market power, thus hindering competition. (Casu and Girardone, 2009) On the other hand, it has been pointed out that if these changes are driven by scale economies, they can in fact improve efficiency (Casu and Girardone, 2009; Căpraru and Pintilie, 2017).

At the EU-level, the European Commission (EC) is in charge of competition policy (Casu and Girardone, 2009). An extremely relevant aspect of competition policy in the light of bank competition is handling bank consolidation, that is, mergers and acquisitions. This policy aspect is pointed out because it will be particularly relevant later on in the paper in the discussion of the use of different competition indicators.

3. On the categorization of competition measures

A clear distinction of bank competition measures can be made between structural and non-structural indicators. The former type measures market structure whereas the latter directly focuses on bank conduct.

In the beginning of research on bank competition, the focus was clearly on how structural characteristics of the market influence bank performance (Căpraru and Pintilie, 2017). This approach is part of traditional industrial organization (IO) economics. The traditional IO approach is based on the Structure-Conduct-Performance (SCP) model developed by Edward Mason and Joseph Bain which assumes that greater market concentration leads to less competitive bank conduct and, hence, greater profitability. (Weill, 2013) According to the model, market structure determines how businesses for example set prices, invest in research and development, and make decisions about advertising expenditure. This business conduct then determines performance which consists of factors such as profits and growth. (Căpraru and Pintilie, 2017) Hence, the approach assesses competition by measures of market structure. Structural tests were used especially widely until the 1990s. (Weill, 2013) Putting the logic of structural measures simply: a concentrated market is assumed to cause weaker competition.

Traditionally, authorities in charge of competition policy have focused to a great extent on structural measures (Bolt and Humphrey, 2009). As mentioned earlier, the EC is in charge of competition policy at the EU-level. When executing competition policies, the process of the EC has started by defining the markets, both geographical and product, that are relevant to the case in question and then applying rules that are based on the traditional IO theory. (Casu and Girardone, 2009)

Although non-structural indicators, which will be defined and discussed more in detail next, are clearly preferred over structural indicators by academics, there are some relevant arguments for using structural tools. They offer a simple way for competition policy authorities to identify which cases need to be investigated with more scrutiny. (Casu and Girardone, 2009) For these reasons, even in the more recent years, De Jonghe et al. (2016) still reports wide use of structural measures in policy-related contexts. There is also considerable difficulty associated with defining the inputs and outputs of banks, which the use of non-structural tools requires. Additionally, even the same indicators can be calculated using slightly different definitions of inputs and outputs. These factors could be interpreted as support for the more straight-forward structural indicators. (Casu and Girardone, 2009)

The aforementioned non-structural indicators, on the other hand, fall under the new empirical industrial organization approach (NEIO). The development of NEIO-based measures can be justified, for example, with the Efficient Structure Hypothesis (ESH) originally introduced by Harold Demsetz in 1973 and Samuel Peltzman in 1977: It suggests that market concentration can simply be a reflection of more efficient banks gaining market share. That is, higher efficiency causes higher profitability and, as a result, market concentration. The ESH questions the validity of the SCP model and the use of concentration measures as proxies for competition. (De Jonghe et al., 2016)

There are several arguments in favor of using non-structural indicators of competition. They measure bank behavior directly instead of using market shares as proxies for competition (Weill, 2013). By doing so they recognize that factors other than market structure can greatly affect competitive behavior, and that concentrated markets do not automatically lack competition. (Casu and Girardone, 2009) Supporting preference of non-structural measures over structural ones, van Leuvensteijn et al. (2007) point out that contradictory to the idea of high market concentration being indicative of low competition, strong competition can in fact sometimes force consolidation and, hence, higher concentration.

It is beneficial to explicitly point out before further discussion of the indicators that with many of them a high value refers to low competition i.e. the value of the indicator and the level of competition develop in opposite directions. The following sections are written so that it is carefully mentioned which phenomenon – an increase in the value of the measure or an increase in the competition level – is in question but it is, nevertheless, worth paying attention to when interpreting the results from the literature review. Another point worth noting is the meaning of using words ’competition’ and ’market power’. A glossary of statistical terms by the Organization for Economic Cooperation and

Development defines market power as "the ability of a firm or group of firms to raise and maintain price above the level that would prevail under competition". That is to say, an increase in market power is parallel to a decrease in competition, and vice versa. The two terms are used in this paper to refer to the two sides of the same phenomenon.

The two following sections present and discuss empirical findings about the development of bank competition in Europe. They are structured to follow the distinction between traditional IO and NEIO approaches outlined above. Section 4 focuses on findings from structural indicators and section 5 on those from non-structural indicators.

4. Structural indicators

Measures that are based on the SCP model seem to be used relatively little in academic literature, at least in the context of European integration. This section addresses the two most commonly appearing ones: concentration ratios and the Hirschman-Herfindahl index. Some studies also report the number of banks operating in the market as a measure of market structure but it is left out of this paper due to its highly simplistic approach.

4.1 Concentration ratios

One of the simplest ways to measure competition based on the market structure is through investigating concentration ratios. They measure the market share of the largest banks in terms of assets held by them. Most commonly the ratio considers the top-3 or top-5 banks, referred to as CR3 and CR5, respectively (Andrieş and Căpraru, 2012). Alternatively, the ratios can be computed based on total deposits or loans instead of total assets, depending on what exactly is the purpose of using the measure (De Jonghe et al., 2016). This simple measure is expressed as

$$CR_n = \sum_{i=1}^{n} ms_i$$

where n indicates how many largest banks are included in the measure, and ms_i represents their respective market shares.

In the period from 1997 to 2003 Carbó et al. (2009) report an EU-level increase in CR5 from 46% to 53%. According to De Jonghe et al. (2016), the concentration level measured with CR5 fell in the early 2000s which was followed by an increasing trend that started around 2006-2007 and continued until the end of their investigation period, i.e. 2015. The highest value was approximately 81% in 2014-2015 while the lowest value, which was found in year 2005, was slightly below 78%. As can be seen from these figures reported by De Jonghe et al., the variation was not very large. Combined with the earlier results from Carbó et al., it seems that European banking markets have been much more concentrated in the 21st century than at the turn of the millennium. It should be noted that potentially increased concentration does not sufficiently explain the difference between the values reported by the two studies since their timeframes overlap and, yet, no similar values occur in their results. There must be some variation in the specifications used to calculate the concentration ratios.

4.2 Hirschman-Herfindahl index

Moving on from the simple concentration ratios, the Hirschman-Herfindahl index (HHI) is a quite widely used example of a structural indicator. It is calculated as the sum of squared market shares of all banks in the market (Casu and Girardone, 2009):

$$HHI = \sum_{i=1}^{n} (ms_i)^2$$

where ms_i is the market share of bank i as a percentage and n is the number of banks operating in the market. One clear advantage of the HHI over concentration ratios is that it takes into consideration all the banks in the market instead of only providing information about the few largest banks.

A high HHI value indicates a high degree of concentration in a market. A value of 10,000 (= 100^2) indicates only one bank in the market whereas a large number of banks that each have a market share close to 0 yields an HHI value close to 0. (De Jonghe et al., 2016) Yet, the index does not have a certain reference point, for which reason there is no simple interpretation as to what kind of levels are considered high (Carbó et al., 2009). Using the HHI, Carbó et al. ranked Greece and the Netherlands as the most concentrated banking markets within the EU in 1995-2001, whereas Germany and Luxembourg showed lowest concentration levels.

Comparing five majors banking markets – France, Germany, Italy, Spain and the UK – in 2000-2005 Casu and Girardone (2009) found that the HH index increased in all these countries except for Spain. The largest increase in absolute terms was seen in France from an HHI value of 587 to 758. In relative terms the UK's increase from 264 to 399 was even greater. In relation to one another, the most competitive banking market was, throughout the investigation period, Germany.

In the context of competition policy, estimating changes in the HH index – a method called HHIΔ – associated with a merger or an acquisition, is used by authorities to infer how much said activity would affect the market structure. (Casu and Girardone, 2009)

5. Non-structural indicators

In academic literature, much more weight is given to non-structural indicators. In this section, the analysis of bank competition in Europe is mostly driven by results found using measures called the Lerner index and the H-statistic. Following them, the Bresnahan index is introduced and applied but it should be noted that it actually does not exactly fall into the category of non-structural measures as it is concerned about how other banks respond to the actions of one bank and, hence, takes into consideration structural aspects as well. However, its approach differs so much from the solely market-share-focused indicators discussed in the previous section that it is instead included here. The section ends with addressing the return on assets and the net interest margin and their contribution to the discussion.

5.1 Lerner index

Based on the literature reviewed for this paper, the most widely used indicator of bank competition is the Lerner index which was introduced by Abba Lerner in 1934. De Jonghe et al. (2016) also claim it to be the most commonly used. Due to its prominence in literature on the topic, the Lerner index is given considerable focus in this paper.

Effectively, the Lerner index calculates how much above the marginal cost a bank fixes its prices and expresses this difference as a ratio to the price:

$$L = \frac{P - mc}{P}$$

There might be slight differences in how the prices and costs are defined but a similar logic has been applied by, for example, Fernández de Guevara et al. (2007), Carbó et al. (2009) and Weill (2013): The price in the calculation is the average price of banking output, which is proxied by the ratio of total revenues to the bank's total assets. To compute the marginal cost, researchers use a translogarithmic cost function that takes prices of labor, capital and borrowed funds as input prices and uses them to explain one output, that is, total assets. In some research, the same cost function is used for all countries in the sample and the country-specific effects are accounted for using a fixed effects method (e.g Weill, 2013) while some estimate a separate cost function for each country (e.g. Fernández de Guevara et al., 2007). In the case of perfect competition, the index gets a value of 0 indicating that banks do not have market power and cannot price over their marginal costs. The larger the index, the weaker is competition in the market. (Fernández de Guevara et al., 2007)

Fernández de Guevara et al. (2007) calculated Lerner indices for 15 EU countries over the period of 1993-2000. Their sample consisted of a wide variety of different types of banks. The researchers found that the EU-level index slightly increased from 0.132 in 1993 to 0.145 in 2000. Ten out of the fifteen countries in the sample showed increased market power at the end of the period under consideration. In 2000, the index exceeded 0.20 in Finland, the UK, Italy and Spain. The most competitive banking sectors, on the other hand, were Luxembourg, Denmark and Germany. Based on these findings, the deregulation process carried out during the 1990s did not improve competitive conditions in most of the EU banking sector even though there seemed to be a general view that competition should have increased.

According to Carbó et al. (2009, the mean value for the index in a sample of 14 European countries over 1995-2001 was 0.16, with Denmark and Spain being the least competitive with average values of 0.22 and 0.20 respectively, while Luxembourg and the UK appeared the most competitive with an index of 0.11 each. Interestingly, Denmark was the least competitive country even though Fernández de Guevara et al. (2007) had ranked it among the most competitive.

In the decade following the studies by Fernández de Guevara et al. (2007) and Carbó et al. (2009), Andrieş and Căpraru (2012) used the Lerner index in a sample of commercial banks from all the 27 countries that were EU members. Their study covered the years from 2001 to 2009. The EU-level

index decreased from 0.8101 in 2001 to 0.7252 in 2009 which indicates increased competition. The values they report are, however, significantly higher than those found in earlier studies. A possible explanation is that Andrieş and Căpraru's sample only consisted of commercial banks whereas Fernández de Guevara et al. and Carbó et al. also included cooperative and savings banks. The implications of bank specialization will be discussed more in section 8.4

Weill (2013) also used the Lerner index to try and provide evidence of increased bank competition around the same time as Andrieş and Căpraru, more specifically in years 2002-2010, but found no general improvement. As in the studies by Fernández de Guevara et al. and Carbó et al., Weill also investigated cooperative and savings banks in addition to commercial banks, which makes their results more similar to one another than to those of Andrieş and Căpraru (2012). The reported indices from Weill's sample of all EU member states range from 0.122 to 0.203.

Weill found an increase in the index in 23 out of the 27 countries in years 2002-2006, that is, before the financial crisis. This was followed by a decrease in most of the countries from 2006 to 2010. This indicates that during and after the financial crisis, banks' market power decreased, and competitive conditions tightened.

A comprehensive study covering all EU28 countries in years 2005-2015 by Căpraru and Pintilie (2017) calculated a mean Lerner index of as low a value as 0.069. The sample included commercial, cooperative and savings banks so the difference in comparison to earlier results cannot be surely attributed to a different constitution of the sample in terms of bank specialization. If the results can be reliably compared to those of earlier studies, the significantly lower index values could indicate improved competition levels in the EU. Competition first increased during 2005-2007, remained quite stable in 2007-2009, then fell until 2011 and was relatively stable with a slight upwards trend in 2011-2015.

De Jonghe et al. (2016) report the following evolution of EU-level competition measured with the Lerner index in EU28 countries between 2000 and 2015: A small increase in competition in the very beginning of the 2000s is followed by a few years of decline. Around 2005 competition remains somewhat stable, and then increases back to similar levels as in the beginning of the decade just to decrease again during and immediately after the financial crisis. After a slight increase in 2010, there is a clear decreasing trend until 2015 leading to lowest levels of competition noted during the investigation period. The reported values for the EU-wide index range from approximately 0.18 to

0.23, with a mean of 0.204. Even though the studies by De Jonghe et al. (2016) and Căpraru and Pintilie (2017) investigate competition around the same time, the results from Căpraru and Pintilie are significantly lower. The values reported by De Jonghe et al. on the other hand are close to those found by the other researchers whose results were just discussed. Therefore, one should likely be careful when drawing conclusions based on the findings by Căpraru and Pintilie as they differ so significantly from other research reviewed in this paper.

Using the Lerner index has been criticized for focusing on banking services where information about the prices is easily available and leaving other activities outside the scope (Bolt and Humphrey, 2009). Furthermore, its validity can suffer in case banks do not function efficiently in terms of their costs (Koetter et al., 2012; as cited in Căpraru and Pintilie, 2017). In general, measuring competition often brings about this issue related to the reported costs that are used to construct indicators: if the costs are not close to their minimum, profits or mark-ups appear lower and suggest greater competition than there actually is. (Bolt and Humphrey, 2009)

5.2 Efficiency-adjusted Lerner index

Due to this very flaw associated with inefficiency in terms of costs, Căpraru and Pintilie (2017) also compute an efficiency-adjusted form of the Lerner index in their study. It is among the most recent indices. The form of the adjusted Lerner index expressed by Căpraru and Pintilie is the following:

$$adjusted\ L = \frac{\pi + tc - mc * q}{\pi + tc}$$

Where π = profit, tc = total costs, mc = marginal costs and q = total output.

The logic of the efficiency-adjusted Lerner index is the same as that of the regular Lerner index; it takes values between 0 and 1, a higher value indicating stronger market power and less competition. Căpraru and Pintilie (2017) report an average adjusted Lerner value of 0.11 in their sample of all EU28 countries in years 2005-2015 as opposed to the regular Lerner index of 0.069 mentioned earlier. The development of the adjusted Lerner index during the period under investigation is very similar to the regular Lerner index – unsurprisingly so since they are just slightly differently specified versions of the same index. The adjusted version remains slightly above the regular Lerner during the

whole period. This implies that when adjusting for efficiency, competition appears slightly weaker than with the regular index.

This efficiency-adjusted form of the Lerner index has not been widely applied and therefore does not lend itself to more thorough analysis. The takeaway from it is that when the measurement process takes into account the fact that reported costs might not be close to their minimum and adjusts the measure accordingly, banks' pricing power might be slightly stronger than with the unadjusted index.

5.3 H-statistic

Another important non-structural measure that has been used widely alongside the Lerner index is the H-statistic which is part of a model called the Rosse-Panzar model. To compute the H-statistic one calculates the elasticity of total revenues to input prices – labor, physical capital and borrowed funds. (Weill, 2013) This calculation goes beyond the simple determination of elasticities of one factor to another as it includes several input prices as well as bank-specific control variables. A presentation of the exact specification can be found for example in Bikker et al (2010).

The final H-statistic is expressed as the sum of these elasticities. In the case of perfect competition, the value is 1 because marginal costs equal price, and the effect of increased input prices is to increase marginal costs. In the case of a monopoly, the value is 0 or even below. Values between 0 and 1 indicate monopolistic competition. In contrast to the Lerner index, the H-statistic provides an aggregate measure of competition, not one on the level of individual banks (Weill, 2013). With the H-statistic, its value and the level of competition develop in the same direction.

Weill (2013) reported an overall decrease of 0.22 in the H-statistic from 2002 to 2010 in the EU member states. All but five of the 27 countries showed decreased levels of competition. Looking at the results within more specific time frames, Weill found that the average H-statistic value first increased between 2002 and 2006 from 0.4545 to 0.5847 and then fell to 0.2346 by year 2010. The drop between 2006 and 2010 did, however, consist of an initial increase between 2006 and 2008, and then a strong decrease during the last two years. These results indicate that, according to the Rosse-Panzar model, bank competition first increased in the EU prior to the financial crisis as well as during the beginning of the crisis but then decreased in years 2008 to 2010. Comparing to Weill's results from using the Lerner index in the same 2013 study, the two measures are in line with one another

for all but the last two years of the period under investigation, during which time the measures indicate development in opposite directions.

Around the same time, in 2001-2009, Andrieş and Căpraru (2012) reported values of the H-statistic that are notably higher. They range from 0.5969 to 0.8869. There does not seem to be any clear trend in the value. It varies but does not show any increases or decreases that would last longer than a year or two.

5.4 Bresnahan index

The Bresnahan index is a model of banks maximizing their profits in an oligopoly situation. The model computes an expression of conjectural variation of an average bank. Conjectural variation refers to "the change in output of all remaining [banks] anticipated by [bank] i in response to an initial change in its own output". The value of the expression of this variation is referred to with λ and it takes values between 0 and 1, 0 indicating perfect competition. (Bikker, 2003). For the original computation of the method and the steps taken to reach λ, see Bresnahan (1982) and Lau (1982). Expressing λ mathematically,

$$\lambda = \frac{dQ}{dq_i} \div n$$

where Q is the total output by all banks, q_i is the output of bank i, and n is the number of banks.

Bikker (2003) applied the Bresnahan index to a sample of nine countries – Belgium, France, Germany, Italy, the Netherlands, Portugal, Spain, Sweden and the UK – in a time period starting from the late 1970s up to the late 1990s. This coincides only partly with the period of interest in this paper and therefore does not offer much to the discussion. It can still be used to demonstrate the use of the Bresnahan index and to get some additional ideas about the state of bank competition during the 1990s.

Bikker (2003) estimated the model separately for deposit markets and loan markets. The values of λ they found in deposit markets are very close to 0, ranging from 0.000001 in the UK to 0.009889 in Sweden. For Portugal, a negative value was computed which indicates a non-equilibrium situation. The null hypothesis in the study was that $\lambda = 0$, and the values were only significantly different from 0 for Germany and Spain so it cannot be rejected that in the other countries competition was possibly

perfect. In Germany and Spain, competition was non-perfect. Their respective values of λ, 0.000627 and 0.000504, imply that the use of market power was potentially stronger in Germany. For loan markets, the perfect competition hypothesis can be rejected in five out of nine countries. Highest values of λ, i.e. lowest competition, were found in the UK, Portugal and Sweden, respectively. In general, results for both deposit and loan markets indicate high levels of competition during the investigation period. This seems a little surprising since the study covers years prior to and at the start of the steps taken towards deeper integration in the 1990s.

Bikker (2003) points out the challenge of finding sufficient data for computing the Bresnahan index. Similarly, Maudos and Vives (2019) who recently reviewed studies about the evolution of bank competition in the EU criticize the index for being complex to estimate, although they make a point that it might be more accurate as a measure of competition than for example the H-statistic, the Lerner index and the Boone indicator (the last of which is introduced later in section 6.2).

5.5 Return on assets and net interest margin

Calculating the return on assets (ROA) takes into consideration all of the bank's income sources instead of only focusing on some aspect of bank activity, for example loan-and-deposit activities. ROA expresses the bank's net income as a ratio to its total assets, which gives insight into how profitable the bank is. It is essentially a very broad measure. According to Carbó et al. (2009), the highest profitability, which can indicate lower competition, was found in 1995-2001 in Greece and Denmark. Germany and Luxembourg, on the other hand, showed lowest profitability.

Carbó et al. (2009) used the net interest margin as one of the indicators in their study. It essentially reflects the difference between loan and deposit interest rates. According to the measure, Denmark and Italy had the highest margins, i.e. the lowest competition level, and at the other extreme were Luxembourg and Ireland.

Net interest margin only reliably covers traditional loan-and-deposit activities whereas many other indicators can be applied to a wider range of bank activities. (Carbó et al., 2009) The prevalent mixing of traditional and non-traditional activities and their respective weights in banks' revenues cannot be reflected in indicators such as the net interest margin, as also pointed out by Carbó and Rodríguez (2007). Neither the ROA nor the net interest margin have been widely applied to measure bank competition so a more thorough discussion on them would not serve the purpose of the paper.

6. Developing new indicators

Based on the discussion above, it is clear that there is variation in the results from using different indicators. Although all indicators aim to give insight into the competitive environment, they tend to measure different things. More thorough comparisons between different indicators are done later in section 7 but the mentioned variation and shortcomings have called for developing new indicators in more recent literature. A few of these newer approaches are introduced in this section and then the discussion on them is followed by a comparison section to which some of these measures offer more depth.

6.1 Bolt and Humphrey's frontier approach

In their 2009 study Bolt and Humphrey constructed an alternative indicator of competition. They borrowed the method used in cost efficiency frontier analysis, which essentially adopted a reverse approach to that of more traditional competition indicators. Most literature in the area treats banking revenue as a function of competition and assumes that the portion that cannot be explained by competition is due to the influence of costs and productivity. Bolt and Humphrey, on the other hand, begin by expressing revenue as a function of costs and productivity, and infer the influence of competition from the unexplained portion.

In constructing their model, Bolt and Humphrey (2009) consider two revenue sources: non-interest income from fees and trading, and the difference between loan and deposit interest rates i.e. the net interest margin (referred to as net interest rate spread by the researchers but essentially the same thing). They formulate functions with eight independent variables that indicate costs, productivity and risk to explain variation in said revenue sources.

To determine a frontier, Bolt and Humphrey (2009) use a method called composed error Distribution Free Approach. The specifics of the method are beyond the scope of this paper but of relevance is that the equation used to explain variation in revenue leaves as a residual two terms, one of which accounts for random error and is assumed to be 0 on average while the other is the portion of revenue variation that underlying costs and productivity could not explain. This latter part is taken to represent the effect of competition. The bank or country for which this last residual term is the lowest has the greatest amount of its revenue variation explained by costs and productivity. This minimum value then defines the competition frontier, and the relative competition efficiency (CE) of each bank or

country is determined by how much they deviate from the frontier. The larger is the CE, the greater is the unexplained portion of the revenue function and, hence, the weaker is the ability of competition to push down revenues. This method does not come without shortcomings either as the CE only indicates relative levels of competition within the sample and cannot construct absolute measures to be used outside the context of the sample.

Applying the CE method to the context of bank competition in the EU, the CE values reported by Bolt and Humphrey (2009) are low which suggests that there are only small differences in the competitive efficiency of the 11 EU countries used in their sample. With non-interest activities the three most competitively efficient countries were the UK, Spain and France whereas with the interest rate margin the top places were taken by France, Spain and Belgium. Interestingly, the UK was the very last in the context of interest rate margin estimates regardless of taking the top place in non-interest activity related competitive efficiency. As said, the differences found were very small so too strong conclusions should not be made. In the category of non-interest income, the CE values were higher which suggests that the competition forces are relatively weaker in that area. This can, to an extent, be used to understand the expansion of such priced activities in relation to loans and deposits. Weaker competition can make it easier for banks to enter the product market for such activities.

6.2 Boone indicator

Another indicator that connects efficiency to levels of competition is called the Boone indicator. It was developed through multiple theories by Jan Boone in the early 2000s. It was first used in the context of bank competition by van Leuvensteijn et al. (2007). As an approach, the Boone indicator is related to the Efficiency Hypothesis introduced by Goldberg and Rai (1996) and Smirlock (1985) which suggests that differences in performance and profits are attributable to differences in efficiency. It is also in line with Demsetz and Peltzman's Efficient Structure Hypothesis (EHS) which was discussed earlier. One of the underlying ideas of the indicator is that competition enhances the performance of efficient banks while impairing that of inefficient banks. Efficiency is understood to mean low marginal costs. The enhanced performance is then reflected in gaining market share and higher profits, an effect which is assumed to be stronger the higher the competition. (van Leuvensteijn et al., 2007

Van Leuvensteijn et al. (2007) use the theory laid out by Boone et al. (2004) to compute the indicator. They end up with the following expression of market share ms_i:

$$ln(ms_i) = \alpha + \beta\ ln\ (mc_i).$$

where mc_i = marginal costs and α and β are parameters. Again, to review the specific steps taken to reach this expression, see the study referenced.

As said, the model assumes that efficiency i.e. low marginal costs enhances performance which leads to an increased market share. Due to this negative relationship between marginal costs and market share, the beta in the expression above is negative. The stronger the competition, the more negative the beta. This beta is in fact the Boone indicator.

Van Leuvensteijn et al. (2007) applied the Boone indicator to banking markets in France, Germany, Italy, the Netherlands, the UK and Spain in years 1992-2004. Their sample focused on commercial, cooperative and savings banks, and also included mortgage banks but left out more specialized institutions such as investment banks. To calculate marginal costs, they estimate a translogarithmic cost function that explains production costs with input prices, output components and control variables, also accounting for bank type and year through dummy variables. In their study, they take a more narrowly defined approach compared to most of the other studies discussed by focusing entirely on the loans segment of the banking market and only include that in the output component of the function.

Out of the six countries under investigation in the van Leuvensteijn et al. (2007) study, Spain, Italy and Germany (in that order) were suggested to have higher competition in their bank loan markets when estimating the indicator for the entire investigation period whereas France was the least competitive, the Netherlands ranking fourth and the UK fifth.

Development-wise Italy is the only one of the six countries that underwent a significant decrease in the level of competition during the sample period, starting from -5.90 and ending up at -1.81. For the rest of the countries there were no significant differences in the values of the indicator in the beginning of the period and at the end of it, although a few noticeable jumps in the middle of the period have taken place. In 2004, the six countries' values range from the Netherlands' -3.09 to France's 0.10 so there are still noticeable differences between countries. (van Leuvensteijn et al., 2007) Compared to the start of the sample period, the countries' indicator values are closer to one another at the end which can be taken to imply that these differences have, however, decreased over time.

One advantage of the Boone indicator is the fact that it can be used to measure competition in specific segments of the banking market, in the case of van Leuvensteijn et al. (2007) the loan market, while many traditional indicators only consider the entire market. The indicator is quite specific in its competition estimation process which can be a strength as it could provide more reliable information regarding a specific segment of the banking market. However, as a consequence of its specificity, it can be misleading to use the indicator to investigate competition on a wider scale as it really does only cover the one specific segment or segments in question. Therefore, attention must be paid to what part of the market the indicator is used to measure. The shortcomings of the Boone indicator include assuming that banks pass on their efficiency gains to customers and that there is no large variation in behavior of different banks in doing so.

6.3 Carbó's adjustments to traditional competition measures

Carbó et al. (2009) point out that indicators can also be influenced by country-specific factors that include but are not limited to cost-efficiency, real economic growth, inflation and the proportion of income coming from non-traditional activities. Carbó et al. developed a new way of measurement through a process of separating the effects of these country-specific factors from the effects of market power per se. In doing so they attempt to provide more consistent estimates of competition levels across countries.

Carbó et al. (2009) also apply methods from frontier efficiency literature. They express four traditional competition measures– namely net interest margins, Lerner index, return on assets, and H-statistic – as equations where independent variables explaining the competition measure are cost efficiency, growth in real GDP, inflation, share of fee income, and a dummy variable identifying the type of bank. These variables are used to reflect the aforementioned country-specific factors. The unexplained portion of the linear equation is then taken to represent the pricing power after being adjusted to these country-specific factors. Due to the nature of the indicators, the researchers found the three measures other than H-statistic more appropriate for the adjustments and preferred them over the latter measure.

The results with the adjusted net interest margins, Lerner index and return on assets were indeed more consistent across the 14 countries sampled in the Carbó et al. (2009) study. They were also lower than results from the unadjusted measures. Ranking-wise, the most competitive banking markets according to the unadjusted measures were Luxembourg, Ireland, the UK, and Germany while with

the adjusted measures the top places were taken by Luxembourg and Greece. The least competitive countries were Denmark, Italy, Spain and Greece when estimated with unadjusted measures, and Denmark and Spain when adjusted measures were used. Similarities can be seen in the results, but the placement of Greece is a deviation worth noting. From the adjusted indicators, one can draw a conclusion, that competition might be stronger than most traditional measures suggest.

7. Comparing indicators

The shortcomings of structural indicators and their potential lack of validity in estimating the level of competition were discussed in section 3. Having now examined various competition measures and made the distinction between structural and non-structural clear, it is worth reviewing some literature that compares the two, as well as measures within the same category.

For example, the conflict between results from different measures has been well demonstrated by Carbó et al. in 2009. They compared Lerner index, H-statistic, Hirschman-Herfindahl index, return on assets, and net interest margin across 14 European banking markets over the period from 1995 to 2001 and found that they were only weakly related to one another. Many researchers have, therefore, called for new alternative competition measures (e.g. Bolt and Humphrey, 2009; Carbó et al., 2009), a few of which were included in the previous section. Further justification for the need for new indicators is the fact that there has been a clear on-going shift in banks' sources of revenue from traditional loans and deposits to non-interest activities. (Bolt and Humphrey, 2009)

Bikker and Haaf (2002) investigated the relationship between market concentration and competition, using the Rosse-Panzar H-statistic as their measure of competition. Their results support the conventional idea that concentration weakens competition. However, also applying the Rosse-Panzar model and comparing it to measures of market structure, Claessens and Laeven (2004) did not find any evidence for the view that banking market concentration is negatively related to competition. In fact, they even found a positive correlation between concentration and competition as measured with the H-statistic, although this finding was not significant. Even though the two studies used the same measure of competition and were conducted around the same time, their conclusions regarding the connection between concentration and competition vary. Yet, the very fact that findings like those by Claessens and Laeven exist, could support the concept of questioning the validity of using market

structure measures. Comparing the more recent Boone indicator to the HH index, van Leuvensteijn et al. (2007) found a weak negative correlation between competition and concentration, supporting the conventional view.

In comparing a set of four market concentration measures – number of banks, CR3, CR5 and HHI – to Lerner index, Boone indicator and H-statistic as examples of conduct-focused measures, De Jonghe et al. (2016) found that out of the bank conduct measures, only Lerner index was positively and significantly correlated with the concentration measures. Within the category of concentration measures, a positive correlation was found between all the measures, suggesting that the choice of measure is not critical when assessing concentration of the market. Lerner index and H-statistic also showed positive and significant correlation but were in fact negatively correlated with the Boone indicator.

8. Further discussion across countries and bank types

8.1 Convergence in competition levels

Although most research reviewed for this paper suggests that the level of bank competition in the EU has not per se increased much, it is of relevance to investigate how much dispersion there remains in competition levels. To measure this dispersion across countries, economists have applied concepts of β-convergence and σ-convergence. The former refers to faster growth (in this case in competition levels) among the countries that start off at the lowest levels. The latter, on the other hand, means that all countries' competition levels converge to the total average, that is, come closer together. β-convergence is a necessary condition, yet not sufficient, for σ-convergence to take place. (Weill, 2013) Weill found both β- and σ-convergence in their estimations of the Lerner index and the Rosse-Panzar model (i.e. the H-statistic), as well as in HHI. Andrieş and Căpraru (2012) also found evidence for both measures of convergence in their study. Additionally, it was already noted in the previous sections that in some of the studies reviewed differences between countries were smaller at the end of the investigation period than at the beginning. This also indicates convergence.

8.2 Distinction between old and new EU member states

In a lot of literature, researchers have found an interesting difference in the evolution of bank competition between old and new EU member states. In the Andrieş and Căpraru (2012) study which showed a general EU-level improvement in competition, indicated by a decrease in the Lerner index from 0.8101 to 0.7252, the index for banks operating in the old member states actually remained quite stable whereas new member states showed significant increase in competition. Over the period from 2001 to 2009, the level of competition in the old EU members fell slightly around the middle of the decade and then by year 2009 rose to just slightly above the 2001 level. New EU members first saw a significant increase in competition from 2001 to 2006 and then a slight decrease. Regardless of this slight decrease in the later years, competition was clearly greater than in the beginning.

When applying the H-statistic, Andrieş and Căpraru (2012) found that competition was on most years greater in new member states. However, it weakened in new member states over the investigation period while in old member states it strengthened. At the end of the period, the difference between the two groups persisted in favor of the new members but was not as significant as in the earlier years.

Weill (2013) also found that in general, new EU member states showed greater competition than old member states in years 2002-2010. Especially during the last years of the period considered, newer members' Lerner indices decreased significantly more than those of old members.

In their EU-wide study over the years 2000-2015, De Jonghe et al. (2016) found that the Lerner indices for the group of 15 older EU members (EU15) and for the 13 new members were quite close to each other for most of the investigation period. However, in 2005-2007, competition decreased in the new member countries whereas it began increasing in the old countries. Newer member countries did follow with a short increase in competition just before the financial crisis, but the level remained much lower than in the EU15. After the crisis both groups showed decreased competition, and the fall in the EU15 was so sharp that for the rest of the period the two groups were once again close to one another in terms of their levels of competition.

As is evident from this discussion, there is some variation in the results about the relative development of old and new EU member states reported in different studies. However, it seems that most findings support the idea that competition has increased more in newer members and also been on a higher level in many occasions.

8.3 Theil index in making comparisons between countries

It is clear that there are differences between country-level indices regardless of which indicator is being used. These differences in competitive conditions can be caused by natural barriers, policy-induced barriers, and bank type. Natural barriers refer to factors such as language and culture whereas policy-induced barriers consist of, for example, taxation and regulation. (Fernández de Guevara et al., 2007)

In order to understand the origins of differences in competition levels, researchers apply an index called the Theil index. Essentially, it breaks disparities in a sample, that can be divided into several groups, into an internal disparity component and an external disparity component. In the context of bank competition, it is first used here to analyze whether greater differences exist between countries or within countries. The effect that dominates gives insight into the main origin of disparities in competition levels. Cruz-García et al. use the terms within-country effect and between-countries effect. A low between-country effect is indicative of a greater state of integration and implies that market power disparities arise from differences in the banks operating in each country rather than from differences between countries. (Cruz-García et al., 2017)

In order to compute the Theil index for bank competition, one needs to know

- The number of countries, n_C
- The percentage of the whole sample that each country represents (in terms of market share), p_C
- Values of the variable the differences of which are under investigation for each bank (i.e. a measure of competition), x_i
- The average of variable x weighted by bank market shares for each country and for the whole sample, μ_C and μ

The internal disparity component T_I and the external disparity component T_E are then calculated according to the specifications in the Cruz-García et al. (2017) study:

$$T_I = -\sum_{i \in n_C} \left(\frac{p_i}{p_C}\right) \log\left(\frac{x_i}{\mu_C}\right)$$

$$T_E = -\sum_c p_C \log\left(\frac{\mu_C}{\mu}\right)$$

The final step is to combine these into the Theil index T:

$$T = \sum_{c=1}^{n_C} p_C T_I + T_E$$

Cruz-García et al. (2017) calculated the Theil index for their estimates of the Lerner index in their sample of the EMU founding countries in years 2000 to 2014 and found that overall differences in market power between banks decreased 35%, most of which was attributable to a decrease in the external disparity component i.e. the between-country effect. They report that disparities within each country had remained stable, suggesting that EU level actions have to be complemented by national level measures to intensify competition within individual countries. Eliminating the differences among countries would leave the major part of margin differences untouched (Fernández de Guevara et al., 2007).

Fernández de Guevara et al. (2007) also found the within-country effect of Lerner index differences significantly more dominant in their study covering years 1993-2000. Though, differences between countries were also growing. In addition, they detected an overall increasing disparity, as did Cruz-García et al. (2017) in the following decade.

8.4 Differences between bank types and a continuation of the discussion on the Theil index

Another approach to investigating the evolution of bank competition is dividing banks according to their specialization instead of their home country and finding out whether differences exist between specialization types. The potential effect of specialization was already hinted at in the section that discussed EU-level Lerner indices and pointed out vast differences across some studies.

Fernández de Guevara et al. (2007) used this categorization approach in their sample. They categorized the banks based on characteristics such as what kind of activities the banks carry out, how they raise funds and what they invest in. The clusters identified were retail banks, universal banks, investment banks and specialized banks. Retail banks refer to a group of savings and

commercial banks in which traditional loan-and-deposit activities play an important role, deposits accounting for 81% of funds and loans 64% of earning assets. Universal banks are somewhat similar to retail banks: their main method of raising funds is also through deposits but the importance of loans as earning assets is more in balance with other assets. Investment banks differ quite a lot from the previous two as 68% of their investments are in assets other than loans. Specialized banks get their funds from sources other than deposits and have a specific purpose, for example mortgage banks. Worth noting is the fact that the categorization and numbers presented do not refer to any specific, generally agreed-upon guidelines or thresholds, but are used by Fernández de Guevara et al. to differentiate between the banks in their sample.

Even before applying the Theil index in the cluster context, Fernández de Guevara et al. (2007) found significant between-cluster differences. Investment and specialized banks' indices approached each other while similar convergence was found between universal and retail banks. Banks with greater traditional deposit-and-loan activity, especially retail banks, had higher Lerner index values which indicates less competition and higher margins. Furthermore, an increasing trend in margins was detected: for retail banks the index increased form 0.1632 in 1993 to 0.1750 in 2000 while for universal banks the corresponding values were 0.1299 and 0.1558. On the other hand, the margins of investment banks and specialized banks decreased from 0.1244 to 0.1191 and from 0.1066 to 0.0961, respectively. This indicates that banks with specific purposes are found to be more competitive. (Fernández de Guevara et al., 2007)

Earlier, the use of the Theil index was discussed in the context of country effects. The internal disparity component referred to within-country variation and the external disparity component to between-country variation. The same logic can be applied to bank clusters as well. Using the Theil index, both within-cluster and between-cluster effects were found to be growing by Fernández de Guevara et al. (2007) but the latter at a faster rate. Going even further, the researchers investigated within-country and between-country effects within each of the specialization clusters and found that between-country inequalities were growing in all categories but investment banks. Within-country inequalities grew in all the clusters, being the highest in investment banking and lowest in retail banking.

Fernández de Guevara et al. (2007) suggest as reasons for lower levels of integration and competition in the retail banking market factors such as customer relationships and the value given to proximity of services.

Differences in the level of competition between bank types have also been investigated by many researchers through a categorization into commercial, cooperative and savings banks. This clearly differs from the categories identified by Fernández de Guevara et al. (2007) in the paragraphs above so the results cannot be compared in a straight-forward manner. It could already be seen in the discussion on the Lerner index that studies that differ from one another in terms of which of these bank types they have in their sample have reported different levels of competition. There are clear differences in the nature of these different bank categories. Van Leuvensteijn et al. (2007) mention a difference in the services provided: cooperative and savings banks are more inclined towards traditional products and services such as loans and deposits, whereas commercial banks offer a more diverse set of products. The researchers also point out that the latter category focuses mainly on larger firms and tends to reach wider geographical markets. Cooperative and savings banks function typically in local markets and attend to retail customer and relatively smaller firms.

Van Leuvensteijn et al. (2007) provide evidence from Germany and Italy in 1992-2004 for the view that there is more competition among commercial banks compared to cooperative and savings banks. In France, however, the different banking sectors seem to be similar in their level of competition.

Adding to these more specific findings about competition disparities between different types of banks, Carbó and Rodríguez (2007) have pointed out a positive relation between market power and the diversity of activities. That is to say, banks with more specialized activities enjoy less market power than do those that function in several markets, in particular if the more diversified banks' activities include non-traditional activities. They can benefit from profits acquired in other markets and then go as far as to push specialized banks out of their respective market. According to these findings by the researchers, competition levels for traditional and non-traditional banking services do seem to be different.

9. Conclusions

The purpose of this paper was to investigate how bank competition has developed in the context of European integration through comparing and contrasting various competition indicators. The conclusion section is twofold in the sense that although the focus is on how bank competition has developed, important findings about the indicators and methodology that were used to obtain information about competition are presented as well. The section starts with those.

Drawing comprehensive conclusions about the state and evolution of bank competition in the EU is no easy task. Many studies only include some of the EU member states and, thus, leave wider comparisons to be done across different studies. Several researchers also point out the challenge of obtaining sufficient data for computing competition indicators (e.g. Bikker, 2003). There are also significant inconsistencies in the results from different studies. Even with the same indicator, researchers report different results.

Based on the discussed findings about the unclear, or even negative, relationship between concentration measures and conduct-focused indicators, it can be concluded that market structure is likely not a good proxy for competition. However, the relative easiness of calculating structural measures does make them relevant for purposes in which detailed analysis is not required. There is significant difficulty associated with obtaining the necessary information about costs needed for computing non-structural indicators.

The somewhat dominant position of the Lerner index in this paper is a combination of a natural reflection of its abundance in literature and a deliberate decision to focus a great deal on an index that allows for more extensive discussion and comparisons. Furthermore, the review presented in this paper does not claim to be an exhaustive list of all indicators used to measure bank competition. For example, the Iwata index developed by Iwata in 1974 has not been applied much empirically (Bikker, 2003) and, thus, does not offer much to the present discussion and is not included.

It is clear based on the literature reviewed for this paper and from other sources, that the weight of non-traditional bank activities is increasing relative to loan-and-deposit activities. In light of this, it seems appropriate to claim that using competition indicators that only take into account interest rates from loan-and-deposit activities can no longer be sufficient. Already in the 1990s and the early 2000s, a decreasing trend of interest margins has been identified to happen simultaneously with increasing market power i.e. lower competition in several European banking markets (Maudos and Fernández de Guevara, 2004) which makes the changing dynamic clear.

Using indicators that only focus on loan-and-deposit activities is of course not a problem if the results are clearly indicated to only apply to such activities. This logic applies to other activities as well. However, many indicators have been criticized for focusing on one portion of banking activities and then inferring competition for the entire bank based on information from the specific activities. Bolt

and Humphrey (2009) suggest focusing on a more narrowly defined range of activities at a time and using indicators that are developed to best suit said activities. Yet, the researchers go on to point out that higher prices and margins in one activity may well be offset by lower or no prices in another and, consequently, such an approach would have to be taken with sufficient caution. One indicator worth noting in this context is the Boone indicator. As demonstrated by van Leuvensteijn et al. (2007), it can be applied to measure competition in an individual segment of the banking market. The Bresnahan index also lends itself to closer assessment of specific segments as could be seen in its application to loan and deposit markets separately by Bikker (2003).

As said, different indicators and studies sometimes give conflicting results and, therefore, the following conclusions have some uncertainty associated with them.

Structural measures seem to have been applied more in older literature so more information is obtained about the market structure of the first two decades of the investigation period of this paper. Both the HH index and concentration ratios indicate increased market concentration, and the finding is consistent in the literature reviewed.

Non-structural indicators rarely indicate increased competition, either. Indices discussed in the paper described slightly decreasing competition during the 1990s (Fernández de Guevara et al., 2007). In the first decade of the 21st century the overall trend in competition was reported to be stable or even weakening (Weill, 2013) but results indicating the opposite i.e. an overall increase were also found (Andrieş and Căpraru, 2012). Addressing more specifically defined time frames, many studies indicate increased competition before the financial crisis, weakened competition during and after it, which was then followed by moderate increases around 2010-2015 (e.g. Weill, 2013; De Jonghe et al., 2016; Căpraru and Pintilie, 2017). In general, most research reviewed does not show long-term increases in competition.

Comparing countries, there are some consistent findings. Germany appears to have been the most competitive or at least among the most competitive in many studies that used non-structural indicators (e.g. Fernández de Guevara et al., 2007; Carbó et al., 2009). It was also reported as the least concentrated market by for example Casu and Girardone (2009) and De Jonghe et al. (2016). Other countries that have been identified among the most competitive include for example Luxembourg and Denmark. Mentions of lowest competition have addressed countries such as Spain, Greece and Italy. However, significant inconsistencies appear as well: Countries that are identified as most

competitive in many studies have also appeared among the least competitive in some and vice versa. Hence, when different methods of measuring competition are taken into account, it might not be possible to provide definite rankings of the European countries. In general, when grouped into old and new EU member states, the new members do seem to show higher levels of competition or at least greater increases in the levels.

Regardless of the lack of evidence for clear increases in competition, findings from the literature review do indicate that convergence has occurred in the competition levels across European countries. The same conclusion has been drawn from several indicators of competition, and with different sized samples of European countries. However, regardless of the indicator used, clear differences still persist among countries. This suggests that there remain significant barriers to integration in banking markets. Going further, convergence towards the law of one price has clearly not been detected. A relevant continuation to the discussion presented in this paper would be to analyze what exactly are these factors that act as barriers to integration and hinder bank competition.

A very relevant point that has come forth in the paper is the difference between competitive conditions facing different types of bank. Competition has been reported to be significantly weaker among banks that focus on traditional loan-and-deposit activities on a relatively local scale. Banks that operate in wider geographical markets and rely less on traditional activities face stronger competition. It seems that separating the different banking types would allow for more thorough analysis. Afterall, the activities of local banks offering traditional services to consumers are very different than for example those of banks that finance large firms abroad.

10. Discussion

In writing this paper, it is acknowledged that the discussion of the exact methodology behind different indicators remains limited. For each indicator, the paper provides an introduction to the steps taken to compute it. The aim of such conduct is to construct a basis for understanding the different approaches of the measures in order to enable comparisons and critical consideration of their results. Methodology is in most parts only discussed in somewhat general, qualitative terms. Where a little more thorough discussion is deemed appropriate with regard to the length and scope of a bachelor's thesis, simple equations are also presented. However, the purpose is not to provide enough information about the specifics of the computation process in order for a reader to apply the measures

solely based on this paper. In the discussion of each indicator, the source where more specific information can be found is referenced. Although crucial for the discussion, the indicators only play a supporting role in enabling deeper analysis of bank competition in the EU. Hence, the depth of describing the methodology is deliberately limited.

It should be acknowledged that much of the research included in this literature review is relatively old. To a certain extent this is deliberate since it was relevant to give considerable weight to research covering the earlier years of the EU. However, part of it was caused by the difficulty of finding newer relevant studies. Based on the literature review, there seems to be some lack of recent research on the topic. Most research from the earlier years of European integration report a lack of increase in competition, and for this reason, it is possible that such findings are overrepresented in the conclusions drawn in this paper.

Many of the conclusions of this literature review can be suggested to have significant policy implications. These include but are not limited to the changing relative dynamics of traditional and non-traditional banking activities, as well as findings about the variation in competition levels within countries and across countries. Some of the straight-forward policy implications have been mentioned but since the purpose is not to be a policy paper, they are mainly left out.

It must be pointed out that all the literature reviewed for this paper was written in pre-Brexit times. The UK has played a significant role in the financial markets of the EU and, therefore, it can be assumed that its departure from the union can have consequences that also influence the competitive environment of the banking market. In the years to come, it will be interesting to see how Brexit affects the topic discussed in this paper.

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